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This programed mathematics textbook is for student use in vocational education courses. It was developed as part of a programed series covering 21 mathematical competencies which were identified by university researchers through task analysis of several occupational clusters. The development of a sequential content structure was also based on these mathematics competencies. After completion of this program the student should know that the word "product" indicates multiplication and be able to: (1) multiply two or three numeric fractions of the form a/b, where 0 is less than (a,b) when these are less than 100, (2) multiply a numerical fraction of the form a/b, where 0 is less than (a,b) when these are less than 100, by a fraction containing a letter and a positive integer less than 100, (3) multiply two literal fractions of the form a/b, (4) multiply a numeric fraction of the form a/b, where 0 is less than (a,b) and these are less than 100, and (5) multiply two mixed numbers of the form Xa/b where 0 is less than (X,a,b) and these are less than 100. The material is to be used by individual students under teacher supervision. Twenty-six other programed texts and an introductory volume are available as VT 006 882-VT 006 909, and VT 006 975. (EM)

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Occupational Mathematics

MULTIPLICATION OF FRACTIONS

June 1968

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Occupational Mathematics

MULTIPLICATION OF FRACTIONS

Project No. 0E7-0031
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Report No. 16-G

by
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June 1968

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Washington State University, Department of Education, Pullman, Washington
State Coordinating Council for Occupational Education, Olympia, Washington

OBJECTIVES

1. The student should know that the word "product" indicates the operation of multiplication.

2. The student should be able to multiply two or three numeric fractions of the form a/b, where $0<(a,b)<100$.

3. The student should be able to multiply a numerical fraction of the form a/b, where $0<(a,b)<100$, by a fraction containing a letter and a positive integer less than 100.

4. The student should be able to multiply two literal fractions of the form a/b.

5. The student should be able to multiply a numeric fraction of the form a/b, where $0<(a,b)<100$, by a constant number less than 100, or a letter.

6. The student should be able to multiply two mixed numbers of the form $X\ \frac{a}{b}$ where $0<(X,a,\text{ and } b)<100$.

Greetings! You are about to begin improving your knowledge of basic mathematics. There are many important uses for the mathematics you are learning.

This booklet is not like your ordinary books. It is designed to help you learn as an individual. On the following pages you will find some information about mathematics. After the information is presented, you will be asked a question. Your answers to these questions will determine how you proceed through this booklet. When you have selected your answer to the question, turn to the page you are told to.

Do not write in this booklet. You may wish to have a pencil and some paper handy so you can write when you want to.

Remember this is not an ordinary book.

1. Study the material on the page.
2. Read the question on the page (you may want to restudy the material on the page).
3. Select the answer you believe is correct.
4. Turn to the page indicated by your answer.

Are you ready to begin?

(a) Yes — Turn to page 1

(b) No — Turn to page C

(c) HELP — Go see your teacher

Your answer was (b) No.

Well, this booklet is a little different.

Go back and read page B again. After you have read it, you will probably be ready to begin.

It will help us to understand the <u>product</u> of two unit fractions by looking at a model. Suppose we want a model for the <u>product</u> of 1/2 and 1/4, or stated another way, 1/2 of 1/4.

The first step is to represent 1/4 as one of four equal parts of a region as shown in figure #1.

Fig. 1

Let us now regard the region representing 1/4 as a unit region itself and take 1/2 of it as shown in Figure #2. The resulting region, representing 1/2 of 1/4 is 1 of 8 congruent parts of the original unit region. Hence, 1/2 of 1/4, or the <u>product</u> of 1/2 and 1/4 is 1/8.

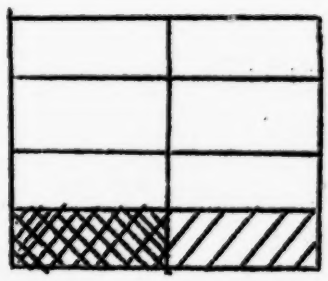


Fig. 2

Question:

What is the product of 3 and 4?

(a) 7 Turn to page 8

(b) 12 Turn to page 5

(c) I don't know what product means Turn to page 2

The word <u>product</u> means the result of two or more numbers being multiplied together.

Example: The product of 4 and 5 is 20.

Question:

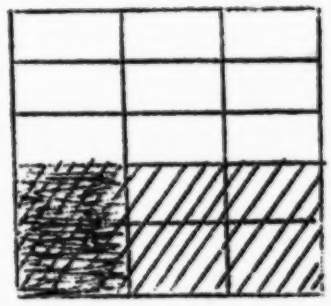
What is the product of 3 and 4?

(a) 12 Turn to page 5

(b) 7 Turn to page 7

Incorrect.

Let's consider the following example. We want to find the product of 1/3 and 2/5. Now 1/3 of 2/5, as shown in the figure at the right, is clearly seen to be 2 of 15 equal parts of the unit region with which we started.



Hence, 1/3 of 2/5 = 2/15. That is 1/3 of 2/5 = $\frac{1 \times 2}{3 \times 5} = \frac{2}{15}$.

What is 2/3 · 4/7?

(a) 8/10 Turn to page 23

(b) 8/21 Turn to page 21

(c) 6/10 Turn to page 17

Good! Your answer of 2/15 is correct.

Question:

2/3 x 1/2 = ?

(a) 2/6 Turn to page 20

(b) 1/3 Turn to page 22

(c) 2/5 Turn to page 12

(d) None of the above Turn to page 3

Your answer was 12. That is correct! You must know that the word <u>product</u> means to multiply.

Question:

What does 1/3 · 2/5 mean?

(a)	I don't know	Turn to page 10
(b)	Multiply 1/3 times 2/5	Turn to page 13
(c)	Add 1/3 and 2/5	Turn to page 16
(d)	divide 1/3 by 2/5	Turn to page 18

Incorrect.

You must have misread page 15.

Go back, reread page 15, and make another choice.

Incorrect.

You must have been in a hurry. Go to page 3 and reread the problem.

Incorrect.

The word product means the result of two or more numbers being multiplied together.

Example: The product of 4 and 5 is 20.

Question:

What is the product of 3 and 4?

(a) 12 Turn to page 5

(b) 7 Turn to page 7

Your answer was 3/28. Correct!

What is the product of 2/3 and 4/7?

(a) 6/10 Turn to page 12

(b) 8/21 Turn to page 21

(c) neither of these Turn to page 3

You answered "I don't know." O.K. Maybe this will help.

Several different symbols indicate that you are to multiply or "find the product of." They are:

"·," "( )( )," and "x."

Examples: $3 \cdot 5 = 15$

$(3)(5) = 15$

$3 \times 5 = 15$

Go back to page 5 and try again.

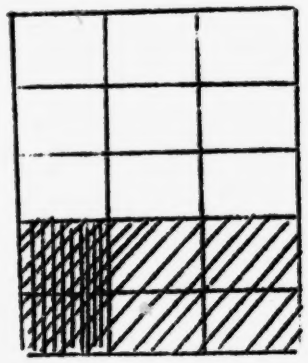
Wrong! You are having trouble multiplying two fractions together.

Go see your teacher for an explanation. Then go back to page 12.

Incorrect.

Let's consider the following example. We want to find the product of 1/3 and 2/5.

Now, 1/3 of 2/5, as shown in the figure at the right, is clearly seen to be 2 of 15 equal parts of the unit region with which we started.



Hence, 1/3 of 2/5 = 2/15.

That is 1/3 of 2/5 = $\frac{1 \times 2}{3 \times 5}$ = 2/15.

What is 2/3 · 4/7?

(a) 8/10 Turn to page 23

(b) 8/21 Turn to page 21

(c) 6/10 Turn to page 17

Correct! 1/3 · 2/5 means you multiply 1/3 times 2/5.

The product of 1/3 and 2/5 is:

(a)	2/8	Turn to page 12
(b)	3/15	Turn to page 15
(c)	2/15	Turn to page 4
(d)	none of these	Turn to page 3

5/24 is the right answer.

Now multiply these two fractions: 5/6 x 2/5 = ?

(a)	1/3	Turn to page 22
(b)	10/30	Turn to page 31
(c)	10/11	Turn to page 12
(d)	7/11	Turn to page 3

Incorrect.

You must have made a careless mistake. $1 \times 2 = 2$.

Therefore, $1/3 \cdot 2/5 = \frac{1 \times 2}{3 \times 5} = 2/15$.

What is $3/7 \cdot 1/4$?

(a) 4/28 Turn to page 6

(b) 3/11 Turn to page 3

(c) 3/28 Turn to page 9

Incorrect.

Several different symbols indicate that you are to multiply or "find the product of." They are:

"·," "( )( )," and "x."

Examples: $3 \cdot 5 = 15$

$(3)(5) = 15$

$3 \times 5 = 15$

Go back to page 5 and try again.

Incorrect.

To multiply fractions, we multiply the numerators together and we multiply the denominators together.

Example: $2/3 \times 5/7 = \frac{2 \times 5}{3 \times 7} = 10/21$.

Question:

(1/4)(5/6) = ?

(a) 5/10 Turn to page 11

(b) 6/10 Turn to page 19

(c) 5/24 Turn to page 14

Incorrect.

Several different symbols indicate that you are to multiply or "find the product of." They are:

"·," "( )( )," and "x."

Examples: $3 \cdot 5 = 15$

$(3)(5) = 15$

$3 \times 5 = 15$

Go back to page 5 and try again.

Wrong!

You are having trouble multiplying two fractions together.

Go see your teacher for an explanation. Then go back to page 12.

Your answer was 2/6. Well, you multiplied correctly; but you didn't reduce your answer. The fraction 2/6 reduces to the lower form of 1/3.

What does 4/12 reduce to?

(a) 1/3 Turn to page 22

(b) 2/6 Turn to page 31

(c) 3 Turn to page 35

(d) I don't know how to reduce fractions Turn to page 20 of Unit 3

Yes, your answer of 8/21 is correct.

(3/10)(4/9) = ?

(a)	2/15	Turn to page 4
(b)	12/90	Turn to page 31
(c)	7/19	Turn to page 23
(d)	none of these	Turn to page 17

1/3 is correct.

What is (5/7)(11/10)?

(a) 55/70 Turn to page 25

(b) 50/77 Turn to page 30

(c) 127/70 Turn to page 27

(d) 11/14 Turn to page 33

(e) I don't know what "( )" stands for
Turn to page 10

Incorrect.

To multiply fractions, we multiply the numerators together and we multiply the denominators together.

Example: $2/3 \times 5/7 = \frac{2 \times 5}{3 \times 7} = 10/21$.

Question:

(1/4)(5/6) = ?

(a) 5/10 Turn to page 11

(b) 6/10 Turn to page 19

(c) 5/24 Turn to page 14

9/25 is the correct answer.

Let's multiply 3/5 times 2/3. Answer is:

(a) 5/8 Turn to page 12

(b) 6/15 Turn to page 31

(c) 2/5 Turn to page 29

Your answer was 55/70, which isn't completely right.

You forgot to reduce your answer.

You can cancel a factor of 5 out of the numerator and denominator, and you will have the fraction:

(a)	11/35	Turn to page 31
(b)	11/14	Turn to page 33
(c)	I need help	Turn to page 20 of Unit 3

Your answer is incorrect.

Let's turn back to page 29 and take our time when working these problems.

Turn to page 29.

Incorrect.

We are supposed to multiply 5/7 times 11/10. You do it like this:

$$5/7 \times 11/10 = \frac{5 \times 11}{7 \times 10} = 55/70.$$

Question:

(3/5)(3/5) = ?

(a) 9/10 Turn to page 28

(b) 9/25 Turn to page 24

(c) 6/10 Turn to page 12

You must not have been paying attention. Now watch!

To multiply 2/3 times 5/7, we multiply 2 times 5 in the numerator and 3 x 7 in the denominator like this:

$$2/3 \times 5/7 = \frac{2 \times 5}{3 \times 7} = 10/21.$$

Now, what is (3/5)(3/5)?

(a) 6/10 Turn to page 12

(b) 9/25 Turn to page 24

Good! 2/5 is the right answer.

Let's try again.

11/12 · 6/7 = ?

(a) 66/84 Turn to page 31

(b) 11/14 Turn to page 33

(c) 66/19 Turn to page 26

Incorrect.

$$(5/7)(11/10) = \frac{(5)(11)}{(7)(10)} = 55/70 = 11/14$$

Remember that in multiplying fractions, we multiply the numerators together and we multiply the denominators together.

Question:

(2/3)(3/5) = ?

(a)	9/10	Turn to page 28
(b)	2/5	Turn to page 24
(c)	6/15	Turn to page 31

Remember that all answers are to be reduced to lowest form. This is done by cancelling <u>like</u> factors from the numerator and denominator.

Example: $9/15 = \frac{3 \times \cancel{3}}{5 \times \cancel{3}} = 3/5$

and

$$12/24 = \frac{\cancel{4} \times \cancel{3}}{\cancel{4} \times \cancel{3} \times 2} = 1/2$$

Now reduce 6/15.

(a) 2/5 Turn to page 29

(b) 3/5 Turn to page 35

Sorry, but you made a mistake.

Here is how to do it:

$$2/3 \cdot 2/5 \cdot 2/6 = \frac{2 \times 2 \times 2}{3 \times 5 \times 3 \times 2} = 4/45$$

Let's try again.

What is (3/5)(2/7)(1/11)?

(a) 6/385 Turn to page 34

(b) 5/23 Turn to page 3

Very good! 11/14 is the correct answer.

What is the product of 1/2, 2/3 and 3/4?

(a) 1/4 Turn to page 50

(b) 5/9 Turn to page 37

(c) 23/12 Turn to page 45

(d) none of the above Turn to page 40

Your answer was 6/385. Good! You multiplied correctly.

Question:

21/25 · 10/7 · 2/27 = ?

(a)	4/45	Turn to page 41
(b)	4/9	Turn to page 40
(c)	Neither	Turn to page 45

Wrong. You seem to be having trouble reducing fractions.

Go to page 20 of Unit 3 and study the material on reducing fractions.

Incorrect.

Here's the way it should be done:

$$2/7 \times 3/10 \times 5/18 = \frac{\cancel{2} \times \cancel{3} \times \cancel{5}}{7 \times \cancel{5} \times \cancel{2} \times \cancel{3} \times 6} = 1/42$$

Try (21/5)(10/49)(1/36) = ?

(a) 31/70 Turn to page 49

(b) 7/294 Turn to page 31

(c) 1/42 Turn to page 43

Nope!

The product of 1/2, 2/3, and 3/4 means:

$1/2 \cdot 2/3 \cdot 3/4$ which equals $\frac{1 \times 2 \times 3}{2 \times 3 \times 4}$

Cancelling like factors in the numerator and denominator like this $\frac{1 \times \cancel{2} \times \cancel{3}}{\cancel{2} \times \cancel{3} \times 4}$, we get 1/4.

What is the product of 2/3, 2/5, and 2/6?

(a) 6/90 which reduces to 1/15 Turn to page 32

(b) 8/90 which reduces to 4/45 Turn to page 41

Incorrect. You must change the mixed numbers into fractions before you multiply. Then 2 2/3 = 8/3 and 3 1/2 = 7/2.

Therefore, 2 2/3 x 3 1/2 = 8/3 x 7/2 = $\frac{8 \times 7}{3 \times 2}$ = 28/3.

Multiply 1 1/4 and 2 3/5.

(a) 2 3/20 Turn to page 42

(b) 3 1/4 Turn to page 46

(c) 9/4 Turn to page 48

Yes, 28/3 is correct.

Is 9 1/3 also a correct answer?

(a) Yes Turn to page 57

(b) No Turn to page 53

Nope!

The product of 1/2, 2/3, and 3/4 means 1/2 · 2/3 · 3/4 which equals $\frac{1 \times 2 \times 3}{2 \times 3 \times 4}$. Cancelling like factors in the numerators and denominators like this $\frac{1 \times \cancel{2} \times \cancel{3}}{\cancel{2} \times \cancel{3} \times 4}$, we get 1/4.

What is the product of 2/3, 2/5 and 2/6?

(a) 6/90 which reduces to 1/15 Turn to page 32

(b) 8/90 which reduces to 4/45 Turn to page 41

Correct!

Let's try this one.

(3/5)(20/6)(1/8) = ?

(a) 23/19 Turn to page 12

(b) 1/4 Turn to page 50

(c) 60/240 Turn to page 31

Incorrect.

You must change mixed numbers to fractions and then multiply as you did before.

Example: $2\frac{4}{5} \times 1\frac{3}{7} = \frac{?}{5} \times \frac{?}{7}$

Which of the following fractions should you have?

(a) 8/5 x 10/7 Turn to page 51

(b) 14/5 x 10/7 Turn to page 55

Good! Your answer of 1/42 is correct.

What is 2 2/3 x 3 1/2?

(a) 9 1/3 Turn to page 47

(b) 6 1/3 Turn to page 38

(c) 28/3 Turn to page 39

(d) none of these Turn to page 52

Incorrect.

Here's the way it should be done.

$$2/7 \times 3/10 \times 5/18 = \frac{2 \times 3 \times 5}{7 \times 5 \times 2 \times 3 \times 6} = 1/42.$$

Try this one.

(21/5)(10/49)(1/36) = ?

(a) 31/70 Turn to page 49

(b) 7/294 Turn to page 31

(c) 1/42 Turn to page 43

Nope!

The product of 1/2, 2/3, and 3/4 means $1/2 \cdot 2/3 \cdot 3/4$ which equals $\frac{1 \times 2 \times 3}{2 \times 3 \times 4}$. Cancelling like factors in the numerator and denominator like this $\frac{1 \times \cancel{2} \times \cancel{3}}{\cancel{2} \times \cancel{3} \times 4}$, we get 1/4.

What is the product of 2/3, 2/5, and 2/6?

(a) 6/90 which reduces to 1/15 Turn to page 32

(b) 8/90 which reduces to 4/45 Turn to page 41

3 1/4 is correct!

Does (7 1/2)(1 2/15) = 17/2?

(a) Yes Turn to page 57

(b) No Turn to page 48

Yes, 9 1/3 is correct!

Is 28/3 also a correct answer?

(a) Yes — Turn to page 57

(b) No — Turn to page 53

Incorrect.

You must change mixed numbers to fractions and then multiply as you did before.

Example: $2\frac{4}{5} \times 1\frac{3}{7} = \frac{?}{5} \times \frac{?}{7}$

Which of the following fractions should you have?

(a) 8/5 x 10/7 Turn to page 51

(b) 14/5 x 10/7 Turn to page 55

Nope!

The product of 1/2, 2/3, and 3/4 means $1/2 \cdot 2/3 \cdot 3/4$ which equals $\frac{1 \times 2 \times 3}{2 \times 3 \times 4}$. Cancelling like factors in the numerator and denominator like this $\frac{1 \times \cancel{2} \times \cancel{3}}{\cancel{2} \times \cancel{3} \times 4}$, we get 1/4.

What is the product of 2/3, 2/5, and 2/6?

(a) 6/90 which reduces to 1/15 Turn to page 32

(b) 8/90 which reduces to 4/45 Turn to page 41

Good! Your answer was 1/4.

Find 2/7 · 3/10 · 5/18 = ?

(a)	30/1260	Turn to page 31
(b)	1/126	Turn to page 36
(c)	None of these	Turn to page 44
(d)	1/42	Turn to page 43

You seem to be having trouble with mixed numbers.

Go to page 118 of Booklet II of Unit 5A.

Incorrect.

You must change the mixed numbers into fractions before you multiply. Then, 2 2/3 = 8/3 and 3 1/2 = 7/2. Therefore, 2 2/3 x 3 1/2 = 8/3 x 7/2 = $\frac{8 \times 7}{3 \times 2}$ = 28/3.

Multiply 1 1/4 and 2 3/5.

(a) 2 3/20 Turn to page 42

(b) 3 1/4 Turn to page 46

(c) 9/4 Turn to page 48

Whoooops!

Do you need some help changing mixed numbers to fractions?

(a) Yes — Go to page 118 in Booklet II of Unit 5a

(b) No, I was just careless — Go back to page 39 and try again

Incorrect.

An integer, like 5, for example, can be expressed as the fraction 5/1. Thus, to multiply fractions by integers, we change the integers to fractions then multiply as before.

Example: $4\ (1/5) = 4/1 \times 1/5 = \frac{4 \times 1}{1 \times 5} = 4/5.$

6 (1/6) = ?

(a) 1 Turn to page 65

(b) 1/36 Turn to page 56

Good! 14/5 x 10/7 is the right answer.

Now if you multiply them together, will you get 4?

(a) Yes — Turn to page 57

(b) No — Turn to page 12

Wrong!

You must have misunderstood the preceding information. Remember that an integer can be written as a fraction by putting the integer over 1. For example:

6 = 6/1, 9 = 9/1, etc.

Return to page 61 and start again.

Your answer was "yes." That is correct!

Now find (6)(1 1/2) = ?

(a) 18/12 or 3/2 Turn to page 61

(b) 9 Turn to page 77

(c) 1/9 Turn to page 54

Correct! You're doing well.

Work this one.

3 x 5/12 = ?

(a) 5/36 Turn to page 70

(b) 8/12 or 2/3 Turn to page 56

(c) 5/4 Turn to page 95

Whoa! You forgot to reduce!

Go to page 31 for more practice.

I'm sorry, but you seem to be having a little trouble.

Go to page 3 for more help.

Incorrect.

An integer, like 5, for example, can be expressed as the fraction 5/1. Thus, to multiply fractions by integers, we change the integers to fractions, then multiply as before.

Example: $4(1/5) = 4/1 \times 1/5 = \frac{4 \times 1}{1 \times 5} = 4/5.$

Question:

6(1/6) = ?

(a) 1 Turn to page 65

(b) 1/36 Turn to page 56

You're doing very well!

Now, if we multiplied k/3 times 2/5, what answer would we get?

(a) $\frac{2}{15}$ K Turn to page 69

(b) 5k/6 Turn to page 82

(c) 2k/15 Turn to page 87

Correct!

Multiply 5/7 times 21. The answer is:

(a) 5/147 Turn to page 70

(b) 15 Turn to page 67

Wrong, wrong, wrong!

How did you get that?

(a) I guess I need some work on multiplying
Turn to page 12

(b) I just "goofed." I would like to try the problem again Turn to page 75

Very good! Your answer was 1.

Try this one.

$5(2\ \frac{1}{10}) = ?$

(a) 10 1/10 Turn to page 68

(b) 10 1/2 Turn to page 58

(c) 21 Turn to page 71

Well, that's close.

However, you should recall that multiplication is commutative so

2a x 2 can be written as

2 x 2 x a or

4 x a or, more simply,

4a.

Hence, 2a/5 x 2/3 = 4a/15.

Try this one.

2k/3 x 6/5 = ?

(a) 4k/5 Turn to page 74

(b) 2k6/15 Turn to page 85

(c) I don't understand the commutative law
Go to Unit 16

Good! 5/7 x 21 does equal 15.

You're ready for another one.

Question:

7/6(9) = ?

(a) 7/2 Turn to page 70

(b) 21/2 Turn to page 58

(c) 7/3 Turn to page 56

Incorrect.

You should first change the mixed number to a fraction and then multiply. Thus, 5(2 1/10) is equal to the product of 5/1 and 21/10. When you <u>multiply</u> and <u>reduce</u>, you get the answer:

(a)	21/2	Turn to page 63
(b)	105/10	Turn to page 59
(c)	21/50	Turn to page 60

Your answer was $\frac{2}{15}$ K. Correct!

Is 2k/15 also a correct answer?

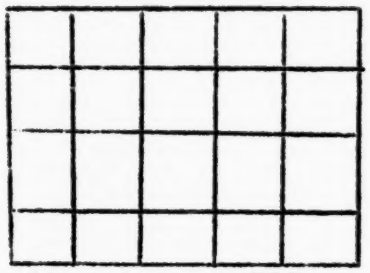
(a) Yes Turn to page 81

(b) No Turn to page 92

No, that's not correct.

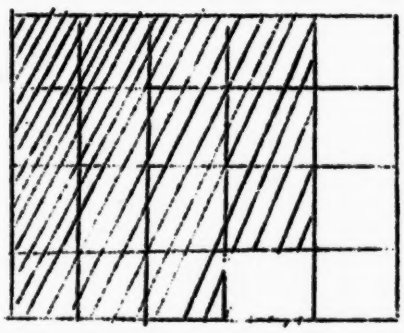
You seem to be having trouble multiplying a fraction times a whole number. Look at it this way:

20(3/4) means 3/4 of 20. Looking at the figure at the right, we see 20 little squares or units of "one."



20 units of "1"

Now how many units of one would we have if we took 3/4 of them? Another way of writing this is to say 3/4 of 20/1 = ?. Well,



3/4 of 20/1 = $\frac{3 \times 20}{4 \times 1} = \frac{3 \times 4 \times 5}{4 \times 1} =$ 15. Now try another one.

What is 10(2/5)?

(a) 4 Turn to page 79

(b) 2 Turn to page 73

(c) 1/25 Turn to page 60

Incorrect.

You should first change the mixed number to a fraction and then multiply. Thus, 5(2 1/10) is equal to the product of 5/1 and 21/10. When you multiply and reduce, you get the answer:

(a)	21/2	Turn to page 63
(b)	105/10	Turn to page 59
(c)	21/50	Turn to page 60

Not quite.

Remember, you must reduce all answers to lowest form.

13k/130 reduced is the fraction:

(a) 10k Turn to page 76

(b) k/10 Turn to page 62

Whooops!

You were not very careful in studying the example.

Go back to page 70 and try again.

4k/5 is correct.

Try this one.

3a/4 . 8/9 = ?

(a) 2a/3 Turn to page 62

(b) 3a/2 Turn to page 82

(c) both answers a and b Turn to page 80

(d) neither a or b Turn to page 90

Good! 4a/15 is correct.

13/5 x k/26 = ?

(a) 13k/130 Turn to page 72

(b) 5k/2 Turn to page 64

(c) k/10 Turn to page 62

Incorrect.

You should recall that you reduce fractions by cancelling like factors from the numerator and denominator.

Example: $3k/6 = \frac{\cancel{3} \times k}{\cancel{3} \times 2} = k/2.$

Reduce 15k/18.

(a) 5k/6 Turn to page 62

(b) 10k/12 Turn to page 83

Correct! (6)(1 1/2) = 9.

Find the product of 4 and 3/12.

(a) 1 Turn to page 95

(b) 12/48 Turn to page 61

(c) neither answer is correct Turn to page 54

Incorrect.

$2/3 \times k/5 = \frac{2 \times k}{3 \times 5} = \frac{2 \times k}{15}$.

However, 2 x k is usually written 2k, so

$$\frac{2 \times k}{15} = \frac{2k}{15}.$$

Try another one.

$(\frac{2a}{5})(\frac{2}{3})$ = ?

(a) $\frac{2a \times 2}{15}$ Turn to page 94

(b) 4a/15 Turn to page 75

(c) $\frac{2a2}{15}$ Turn to page 66

O.K! Now you are doing them correctly.

Let's try one more.

7/10(5) = ?

(a) 2/7 Turn to page 60

(b) 1 2/10 Turn to page 56

(c) none of the above Turn to page 95

Hey, wait a minute! We both know that 3a/2 does not equal 2a/3.

Go back to page 74 and make another choice.

Your answer was "yes." Correct!

Find the product of $4/5 \cdot 10/x$.

(a) $8x$ Turn to page 82

(b) $8/x$ Turn to page 91

(c) 8 Turn to page 89

(d) $40/5x$ Turn to page 72

You forgot how to multiply. Remember that we multiply numerator times numerator, denominator times denominator, and reduce all answers.

Example: $(\frac{3a}{10})(\frac{4}{15}) = \frac{\cancel{3} \times \cancel{2} \times 2 \times a}{5 \times \cancel{2} \times 5 \times \cancel{3}} = 2a/25$

Another example: $(8/k)(9/4) = \frac{9 \times \cancel{4} \times 2}{k \times \cancel{4}} = 18/k.$

(2a/33)(22/5) = ?

(a) 24a/38 Turn to page 84

(b) 4a/15 Turn to page 75

(c) 44a/165 Turn to page 76

You need more work in reducing fractions.

Go to page 20 of Unit 3 and then return to page 1 of this Unit.

Incorrect.

You need more work on multiplying fractions. Turn to page 12.

Incorrect.

I believe you need help on the commutative law.

What would you think would help you most?

(a) Go to a unit on the commutative law
Go to Unit 16

(b) Try the problem again
Turn to page 94

Incorrect.

K, like all other integers, can be written as the fraction k/1.

Following the rules for multiplying fractions, 3/5 x k should equal:

(a)	3k/5	Turn to page 97
(b)	5/3k	Turn to page 93
(c)	3k/5k	Turn to page 101

Your answer was 2k/15. Correct.

Is $\frac{2}{15}$ K also correct?

(a) Yes Turn to page 81

(b) No Turn to page 92

3k/5 is correct.

3/4 · 2A = ?

(a) 3/8A Turn to page 102

(b) 3A/2 Turn to page 111

(c) 2A/3 Turn to page 106

Incorrect.

What happened to the x? You must have forgotten it.

Go back to page 81 and select another answer.

You forgot how to multiply.

Remember that we multiply numerator times numerator, denominator times denominator, and reduce all answers.

Example: $(\frac{3a}{10})(\frac{4}{15}) = \frac{\cancel{3} \times \cancel{2} \times 2 \times a}{5 \times \cancel{2} \times 5 \times \cancel{3}} = 2a/25.$

Another example: $(8/k)(9/4) = \frac{9 \times \cancel{4} \times 2}{k \times \cancel{4}} = 18/k.$

(2a/33)(22/5) = ?

(a) 24a/38 Turn to page 84

(b) 4a/15 Turn to page 75

(c) 44a/165 Turn to page 76

Good! Your answer was 8/x.

What is 3/5 x K?

(a) 3K/5K Turn to page 96

(b) 3K/5 Turn to page 111

(c) 3/5K Turn to page 86

Incorrect.

2K/15 can be expressed as the product of 2/15 and k/1. But k/1 represents or stands for the integer k. Therefore, 2k/15 = 2/15 x k/1 = 2/15 x k = 2/15k.

Choose one of the following:

(a) If you have trouble with letters
Go to Unit 2

(b) I think I understand
Turn to page 81

Nope! Let's look at it this way.

3/5 x k means 3/5 of k units <u>or</u> 3/5 of k/1 units.

Now multiply the two fractions together.

$$3/5 \times k/1 = \frac{3 \times k}{5 \times 1} = 3k/5.$$

Try this problem.

(2/3)(B) = ?

(a)	3B/2	Turn to page 82
(b)	2B/3	Turn to page 104
(c)	2B/3B	Turn to page 99

Well, that's close.

However, you should recall that multiplication is commutative so

2a x 2 can be written as 2 x 2 x a or 4 x a, or, more simply, 4a.

Hence, 2a/5 x 2/3 = 4a/15.

Try this one.

2k/3 x 6/5 = ?

(a) 4k/5 Turn to page 74

(b) 2k6/15 Turn to page 85

(c) I don't understand the commutative law
Go to unit 16

Right! You're doing very well.

Now let's multiply 2/3 times k/5.

(a) 2k/15 Turn to page 87

(b) $\frac{2}{15}$ K Turn to page 69

(c) I don't know what to do with the "k"
Go to Unit 2

(d) 2k/8 Turn to page 78

Incorrect.

K, like all other integers, can be written as the fraction k/1.

Following the rules for multiplying fractions, 3/5 x k should equal:

(a)	3k/5	Turn to page 88
(b)	5/3k	Turn to page 101
(c)	3/5k	Turn to page 93

3k/5 is correct.

3/4 · 2A = ?

(a) 3/8A Turn to page 102

(b) 3A/2 Turn to page 111

(c) 2A/3 Turn to page 106

Incorrect.

The laws of multiplication don't change just because we are using letters rather than numbers.

Remember: $\frac{\text{Numerator times Numerator}}{\text{Denominator times Denominator}}$ = Answer.

$(W/K)(a/b) = ?$

(a) Wb/Ka Turn to page 105

(b) Wa/Kb Turn to page 109

How did you get B in the denominator?

B = B/1 <u>NOT</u> B/B.

(a) I don't know Turn to Unit 2

(b) Just careless. I'll try again
Turn to page 101

You're doing great!

Now work this one.

(12)(2/3K) = ?

(a)	8K	Turn to page 82
(b)	K/8	Turn to page 106
(c)	8/K	Turn to page 111

Nope. Let's look at it this way.

3/5 x K means 3/5 of K units or 3/5 of K/1 units.

Now multiply the two fractions together:

$$3/5 \times K/1 = \frac{3 \times K}{5 \times 1} = 3K/5.$$

Try this problem.

(2/3)(B) = ?

(a)	3B/2	Turn to page 82
(b)	2B/3	Turn to page 104
(c)	2B/3B	Turn to page 99

No. Let's have a closer look.

Remember letters stand for or represent numbers. We treat them the same way as numbers. Therefore,

$A = A/1$ and $3K = 3K/1$ or $\frac{3 \times K}{1}$.

So just multiply the numerators together, then multiply the denominators together and reduce.

$(1/2)(2A) = ?$

(a) $\frac{1}{4}A$ Turn to page 82

(b) $1/A$ Turn to page 106

(c) A Turn to page 100

Incorrect.

The laws of multiplication don't change just because we are using letters rather than numbers.

Remember: $\frac{\text{Numerator times Numerator}}{\text{Denominator times Denominator}}$ = Answer.

(W/K)(a/b) = ?

(a) Wb/Ka Turn to page 105

(b) Wa/Kb Turn to page 110

Good!

Try this one.

2/5 · 5K = ?

(a) 2K Turn to page 100

(b) 2K/25 Turn to page 106

(c) 2/K Turn to page 102

Oops! You were almost done.

$(W/K)(a/b) = \frac{W \cdot a}{K \cdot b} = ?$

(a) Wa/Kb Turn to page 110

(b) Ka/Wb Turn to page 108

Incorrect. You do seem to be having a little trouble.

Well, maybe some more examples will help you.

Examples: $(3/4)(6K) = 3/4 \times 6K/1 = \frac{3 \times 6K}{4 \times 1} = \frac{18K}{} = \frac{9K}{2}$

and $(5)(3/10K) = 5/1 \times 3/10K = 15/10K = 3/2K$

and again $K(2/5) = K/1 \times 2/5 = 2K/5$.

$(12K)(2/3) = ?$

(a) 8/K Turn to page 102

(b) 8K Turn to page 100

(c) K/8 Turn to page 90

Your answer was ax/by. Very good.

You have just completed the Unit. You should be able to successfully work problems where you multiply fractions, mixed numbers, integers, and combinations of these.

Tell your teacher that you are ready for a test over this Unit.

You're not concentrating!

Go back to page 105 and try again.

That's correct!

Try this one.

$(a/b)(x/y) = ?$

(a) by/ax Turn to page 105

(b) bx/ay Turn to page 98

(c) ax/by Turn to page 107

That's correct.

Try this one.

$(a/b)(x/y) = ?$

(a) by/ax — Turn to page 105

(b) bx/ay — Turn to page 98

(c) ax/by — Turn to page 107

Good work!

Now what is (a/b)(x/y)?

(a) ax/by Turn to page 107

(b) ay/bx Turn to page 98

(c) by/ax Turn to page 103

NORTHWEST REGIONAL EDUCATIONAL LABORATORY

CAI MATHEMATICS
TEST QUESTIONS

UNIT 6 - MULTIPLICATION OF FRACTIONS

Directions: The correct answers will always be expressed in lowest terms.

1. The product of 4 and 8 is

   a) 2

   b) 12

   c) 32

2. (1/3) (2/5) =

   a) 2/15

   b) 2/8

   c) 5/6

3. What is x/3 times 2/7?

   a) 6/7

   b) 7/6

   c) 2x/21

4. (a/b) (e/f) =

   a) af/be

   b) ae/bf

   c) bf/ae

5. 3 times 5/6 is

   a) 18/5

   b) 5/2

   c) 15/6

6. Multiply 3 1/3 by 2 1/5

   a) 2/33

   b) 6 1/15

   c) 22/3

7. The word "product" indicates that two numbers have been added together.

   a) Yes

   b) No

8. (3/5) (10/21) =

   a) 63/50

   b) 113/120

   c) 2/7

9. The product of 2/a and 1/3 is

   a) 2/3a

   b) 3a/2

   c) a/6

10. What is 2a/3 times 4/3?

   a) 8a/9

   b) 2a + 4/3

   c) 4a/3

11. (2x/y) (m/q) =

   a) xm/yq

   b) 4xm/yq

   c) 2xm/yq

12. The product of 2/3 and x is

    a) 2x/3x

    b) 2/3x

    c) 2x/3

13. 1 1/4 · 2 2/3 =

    a) 3 11/12

    b) 3 1/3

    c) 2 1/6

14. What is the product of 1/2 and 4/5?

    a) 2/5

    b) 13/10

    c) 5/8

15. The multiplication of 5 times 2/3 is

    a) 2/15

    b) 3 1/3

    c) 2/3

16. 3 1/7 times 2 4/5 is

    a) 5 1/3

    b) 6 4/35

    c) 8 4/5

Unit 6

17. 7/3 times 5/21 is

    a) 35/63

    b) 15/147

    c) 5/9

18. 2 is the product of 2 2/5 and 5/6

    a) Yes

    b) No

19. (1/4) (12/15) (5/6) =

    a) 15/90

    b) 1/6

    c) 2 2/5

20. 3x/2y times p/4k is

    a) 24 (px/ky)

    b) 3px/8ky

    c) 6kx/py

21. k times 5/4 is

    a) 4k/5

    b) 5/4k

    c) 1 1/4 k

22. 4 (3/2) =?

    a) 12/8

    b) 3/8

    c) 6

23. (2/3p) (6/5) =

a) 4p/5

b) 12/15 p

c) 4/5p

24. The product of a/b times d/c is

a) ad/bc

b) ac/bd

c) bc/ad

25. (2x/3) (9/8) =

a) 3x/4

b) 16x/27

c) 3/4

ANSWER SHEET

UNIT 6 MULTIPLICATION OF FRACTIONS

1. c
2. a
3. c
4. b
5. b
6. c
7. b
8. c
9. a
10. a
11. c
12. c
13. b
14. a
15. b
16. c
17. c
18. a
19. b
20. b
21. c
22. c
23. c
24. a
25. a

To the instructor: The above problems are related to the objectives as follows:

OBJECTIVE 1 : Questions 1,7,9,12,14,18,24

OBJECTIVE 2 : Questions 2,8,14,17,19

OBJECTIVE 3 : Questions 3,9,10,23,25

OBJECTIVE 4 : Questions 4,11,20,24

OBJECTIVE 5 : Questions 5,12,15,21,22

OBJECTIVE 6 : Questions 6,13,16,18

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ABSTRACT

One book of a 21-book series of programmed instruction materials designed to help pupils acquire mathematics capabilities most useful in sub-professional level occupations. Other programmed books in the series are:

Symbols
Representing Numbers by Letters
Equivalent Forms
Fraction and Ratio
Addition of Fractions
Subtraction of Fractions
Division of Fractions
Concepts of Decimals and Fractions
Addition and Subtraction of Decimals
Multiplication of Decimals
Division of Decimals
Conversion of Fractions into Decimals
Equivalent Forms of A = BC
Solutions of A = BC
Percentage
Commutative Law
Reciprocals
Scientific Notation
Proportions
Concepts of Number Bases